of Norwich and London, which firm have before this kindly allowed their wire to be freely used for experimental purposes. This wire stretches from Messrs. Colman's works at Norwich to their office in Cannon Street, a distance of a little over 115 miles. The wire runs on the same poles as the numerous other wires of the Great Eastern Railway, and is carried overhead from the terminus in London to Cannon Street. At 4 o'clock the experiments began, and the incessant crackling and bubbling sounds in the receivers revealed the fact that the adjoining telegraph wires were at their busiest, and that induction could hardly be worse. Nevertheless, the first exclamation uttered into the hastily adjusted carbon telephone at Norwich was heard perfectly in the

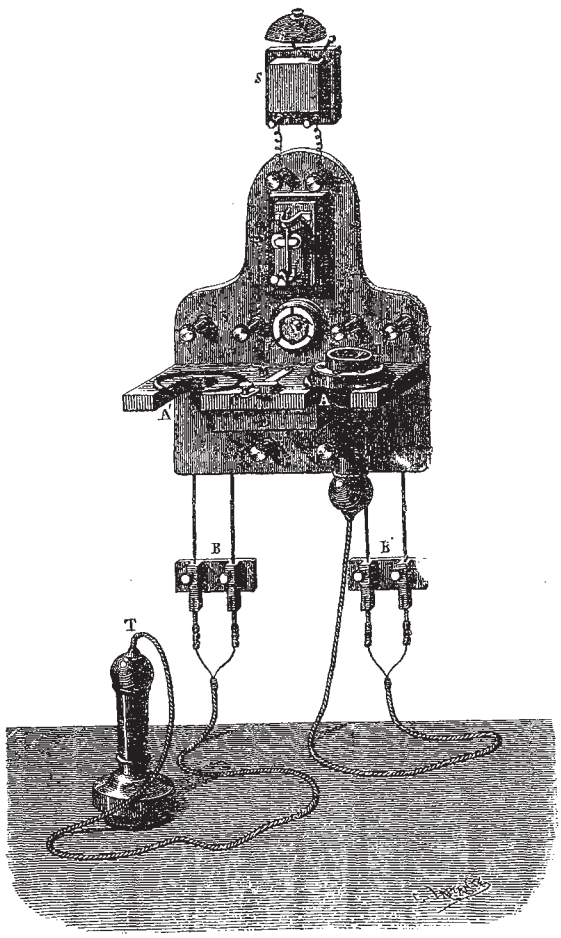

FIG. 4.—General view of the arrangements and accessories of the Carbon Telephone.

counting-house at Cannon Street. Conversation then ensued between the two places; some words were occasionally lost, but the American accent of Mr. Adams, Mr. Edison's professional assistant, who had charge at the Norwich end, was distinctly recognisable in London. Remarks passed on the weather showed that a storm of snow and sleet was going on at both ends, and the insulation therefore almost at its worst. Later on, towards 9 o'clock in the evening, the effects of induction grew less, but were still considerable. The voices from Norwich were now louder, the individuality of the speakers more marked, and conversation could be carried on without difficulty, the voices of certain speakers being remarkably distinct.

Twelve months previously the writer had an opportunity of trying Bell's telephone on the same circuit, when not a word could be transmitted during the day, owing to induction, but at night everything was clearly heard; hence the foregoing experiments established the important fact that in spite of powerful induction operating against it, the Edison telephone is a practicable instrument. It is true that before this telephone can be commercially used, especially during the day and on long lines, special electrical adjustments of the instruments must be made such as the pressure on the carbon and probably the resistance of the induction coil relatively to the line, but in this there is no inherent difficulty, and the adjustment once made no further change is likely to be necessary. Meanwhile we shall await with curiosity the new receiver, which, in a recent letter to the writer, Edison says will arrive in England soon; they differ from other telephones in having "no ear pieces or magnets about them," and according to Edison, "are about twenty times louder than any magnetic telephone, and can, if desired, reproduce the voice at the distant end louder than originally spoken, whilst the whole affair is even cheaper and simpler than the receivers now in use."

It is not impossible that before very long, by means of the Edison telephone, speeches in Parliament may be telephonically transmitted to the newspaper offices and to the country, whilst honourable members, if their articulation be distinct, are speaking from their ordinary places in the House.

W. F. BARRETT

NOTES

THE Corporation of Penzance are, we hear, making preparations to celebrate the centenary of Sir Humphry Davy's birth next month. The Paris Academy of Sciences, who awarded Davy a prize in 1807, when war was raging between France and England, will probably take some part in the celebration.

A COMMITTEE has been formed at Heilbronn with the object of erecting a monument to the memory of Dr. Robert Julius Mayer in his native place. Every one knows that Dr. Mayer's name is associated with the establishment of the mechanical equivalent of heat (see NATURE, vol. xvii. p. 450).

THE Observatory of Geneva has received the gift of an instrument of large dimensions by the generous munificence of its director. Prof. Emil Plantamour, who has occupied this position for about forty years, has constructed, at his own expense, in the existing building, a turret of 7 metres in diameter, surmounted by a cylindrical cupola, in which will be placed an equatorial telescope of 10 French inches aperture and 3·70m. focal distance. The object-glass has been ordered from Merz, of Munich, and the equatorial mounting is being manufactured at the workshop of the Geneva Society for the Construction of Physical Instruments. It is hoped that the new instrument will be in working order about the end of next spring.

DR. CREIGHTON, Demonstrator of Anatomy at Cambridge, has joined the editorial council of the *Journal of Anatomy and Physiology*, which henceforth adds to its title the words "normal and pathological."

WE would call the attention of our readers to a paper, likely to be of some interest, to be read at the meeting of the Physical Society on Saturday, by Messrs. Ayrton and Perry. The title of the paper is "The Music of Colour and of Visible Motion," and from what we can learn of Messrs. Ayrton and Perry's investigations, they claim to have hit on a new emotional art. By means of a new machine which they have devised they can produce combinations of harmonic motions with greater variety than can be obtained with any existing machine. Their idea, we believe, is that, judging from their experience partly of the feelings produced by large bodies in rapid motion and partly from the fact that in Japan posturing takes the place of the operatic

singing of the West they think that colour and motion may be made to produce emotions like good music, and therefore may very likely be employed as adjuncts in the entertainments of the future intended to work on the emotions.

AT a meeting of the Medical Society at University College, Gower Street, on December 3, at 8 P.M., an address on "The Use of Physiology to Medical Students," will be delivered by Dr. Michael Foster, F.R.S.

AT the monthly meeting of the Linnean Society of New South Wales, on September 30, the committee appointed to consider Baron Miklucho-Maclay's suggestion for the establishment of a zoological station at Sydney, presented their report affirming the desirability of forming such an institution. The Hon. W. Macleay having very liberally offered to afford facilities for a temporary zoological station in the vicinity of his residence, and promising the use of his museum, library, and microscopes to students of natural history, the Society adopted the report, and it was agreed to commence operations at once.

FROM a promising new American fortnightly journal, *Science News*, edited by Messrs. W. C. Wyckoff and E. Ingersoll, we learn that Prof. S. P. Langley, director of the Alleghany Observatory, has just started on a voyage to Europe, being commissioned by the United States Coast Survey to make observations to serve as a standard of comparison in determining the requisites for astronomical stations in American territory. The inquiry will have particular reference to the effects of different elevations and atmospheric conditions upon the fitness of various localities for the practical work of astronomy. Prof. Langley goes direct to Paris and thence to Italy; the trip will include an ascent of Mount Etna. In addition to the routine work of the Alleghany Observatory, Prof. Langley has been busily engaged in completing a direct experimental comparison between the heat of the sun and the highest heats attainable in the arts. The results indicate that the sun's *intrinsic* heat is almost beyond comparison greater than that of any blast furnace, and far larger than was reckoned by the French physicists. Prof. Langley has also nearly finished a memoir embodying great numbers of measurements and drawings at the extreme lower end of the solar spectrum, particularly the A group. These are parts of a research supported by the Rumford fund, requiring also a new study of the distribution of energy in the spectrum, as shown by the thermopile: Prof. Edison's tasimeter will probably be tested in the course of the work, using the Rutherfurd gratings to supply the spectra. A great improvement, Prof. Langley hopes, has recently been made by him in the accessories of the diffraction spectroscope, by means of which the use of collimators of extraordinary length will become practicable.

MR. C. E. ALLAN writes that he has constructed a rough pencil microphone, using cinders instead of carbon. This construction was not sensible to small sounds, but speech was transmitted very clearly. The pressure at the points of contact was increased by winding wire round the cinder pencil, and by this means the jarring sound of the cinders was almost totally removed, so that songs, the notes of an organ, and the ordinary tones of the voice were distinctly transmitted.

THE annual exhibition of the Haggerston Entomological Society takes place at 10, Brownlow Street, Dalston, to-day and to-morrow, at six P.M. This exhibition is always well worth a visit.

A CORRESPONDENT in the *Times* states that Mr. Edison, in reply to a telegram, avers that, according to his system, the altering of one light does not in the slightest degree affect others in the same circuit. He can adjust the brilliancy of each light at pleasure, it is stated, so that thus electrical lighting would be as steady and as much under control as gas itself. "Whatever method he uses, Mr. Edison appears confident of the success of his system." Mr. Sawyer, being interviewed by a New York reporter on the subject of his lamp, said he did not claim the incandescence of carbon in a sealed receiver as an idea of his own, but had utilised it in the development of other ideas. He claimed a form of conductor which would radiate the heat produced by the incandescence in such a way that the globe would be heated only at the point where the light was. He had also patented a process for charging the receiver with pure nitrogen gas and entirely displacing the atmospheric air. He had patented a means of so closing the receiver that no atmospheric air could find its way into the interior. The nitrogen, he claimed, would last for ever. Besides, there was a substance in the bag at the bottom of the lamp which would absorb oxygen and carbonic acid gas. These, he said, were his improvements. One lamp had been in use two or three hours daily for three months, until a sudden jarring of a door broke it. There had never been any flaking or change in the carbons used. The only change the carbon underwent was its purification. Bef ore being lit it was a dead black; after being incandescent for a time it took on the silver gray colour characteristic of pure carbon. The sub-division of the light, as produced by Mr. Sawyer's system, consists of branch wires leading from the two main wires of the engine. Each of these branches is calculated to supply a number of lamps. The extension of the main wires necessitates an increased heaviness of the wire for each mile. In lighting New York a radius of only half a mile from each supply station will be actually necessary.

THE Liverpool Corporation are taking steps to utilise the electric light as a public illuminating medium as soon as it is utilisable. They intend to apply to Parliament next session for powers to this purpose, have appointed a committee to watch over the subject, and have despatched their engineer to the Continent to examine into the use of the light in Paris and elsewhere.

A *Daily News* correspondent writing from Naples on the 13th inst. states that the stream of lava from Vesuvius was slowly extending from the cone towards the Atrio del Cavallo, the ravine or valley which separates Vesuvius from Somma. The stream extended almost the whole way into the Atrio del Cavallo, and divided into no less than three large streams. These were increasing in size and extent, and the slight shower of lava had also increased, but it was not sufficient to be observable from Naples.

AN earthquake took place at Sierra Leone on the morning of October 11, shaking every house in the colony, and causing great alarm to the inhabitants, but fortunately no damage of any moment was done. There were three successive shocks felt, travelling inland to a distance of about sixty miles, and the end of each is said by some to have resembled three very heavy peals of thunder following quickly upon each other. The natives in the interior were so terrified that in many cases they deserted their villages. An earthquake of a similar character occurred about fifteen years ago.

A M. BAILEY, of Paris, has invented an electric spark pen which possesses some points of interest. If a sheet of thin paper is attached to a plate of copper or zinc, it is stated that an engraving may be made with extraordinary facility by means of this pen. If one of the poles of a Ruhmkorff machine is attached to the plate and the other to the upper end of the pen, the current will run through, and in drawing the paper is perforated. When the drawing is finished, ink is laid on with an ordinary roller, and the greasy fluid penetrates through the holes. The plate is then plunged in water, which detaches the paper, and it is ready for immersion in the acid. The advantage claimed for this method is that the artist does all parts of his work and has no more trouble than if he were working with an ordinary pencil. He can even work in a dark room without any other light than the glare from the induction spark.

THE *Times* Geneva correspondent states that the remains of another lake village have just been brought to light at Lorcas by the shrinkage of the waters of the Lake of Bienne. This appears to be one of the most interesting discoveries of the sort we have had for some time, rich as have been the last few weeks in notable lacustrine finds. The station at Lorcas, assigned by experts to the age of stone, is situated at a short distance from the lake shore, not far from another and similar station which was explored in 1873. An exploration, conducted by Dr. Gross, of Neuveville, has resulted in the gathering of many novel and interesting objects, pierced stone hatchets similar to those found in Denmark, large flint lance-heads, jade hatchets with stag-horn and wooden hafts fastened with pitch; vessels in wood, among others a colander, and a vase in a good state of preservation. Near these were found several arms and instruments of pure copper, a circumstance which points to the probability that intermediate between the age of bronze and the age of stone was a period when prehistoric man had not discovered the art of alloying copper with tin. This was the age of copper. Still more remarkable is a find of human skulls which bear unmistakable marks of having been trepanned. Round pieces have been cut out, doubtless after death, as is supposed, for use as amulets. In some instances pieces were cut from the craniums of living infants in order, as M. Broca conjectures, to let out the spirit by whose malignant influence they were afflicted with fits, convulsions, and other maladies. These bits of infants' skulls were sometimes used in a way of which an example has been found at Lorcas; they were put inside the heads of the dead to protect them from the wiles and assaults of evil beings in the world of spirits.

A PORTRAIT of the Rev. M. J. Berkeley has been presented to the Linnean Society; it was painted by Mr. Peale at the instance of some of Mr. Berkeley's friends.

M. ROUX has sent to the Society of Encouragement of Paris the results of his experiments on nitro-glycerine, from which it appears that bottles of tinned iron falling from a great height and breaking do not cause a dangerous explosion.

WE have received an interesting syllabus of a course of ten lectures on literary and scientific subjects, to be delivered in the lecture theatre of the Bristol Museum, during the winter.

MR. BROTHERS, photographer, Manchester, asks us to state that the portrait of Sir George Airy, which we gave in a recent number, was from a photograph by him. The copy from which our portrait was taken did not indicate by whom it was photographed.

THE *Yama Sentinel* of California gives an account of a singular specimen of meteoric iron, which resembled steel, that had been found in the Mohave desert. It weighs about a pound, has some free gold on the surface, is not magnetic, and has successfully resisted the action of various acid baths. One of its surfaces shows a fracture of crystalline appearance, the colour of which is steel gray tinged with yellow. It has defied the best cold chisels, and has neither broken nor chipped under heavy blows. If its composition could be imitated it would be the hardest and toughest alloy known.

BEING at Osaka recently, a correspondent of the *Kobe Advertiser* was invited to inspect the cotton-mills and spinning-factory which was established at Sakai some years ago, but has attracted little notice. The account which he gives of his visit furnishes additional testimony of the progress which the Japanese are so rapidly making. The premises in question cover 7,000 tszuboes of ground, and the buildings thereon are substantially and well built, and the greater part of the machinery was imported from England. It is not necessary to enter upon the description of the internal arrangements of the establishment, but it is interesting to learn that "in this factory are employed about 150 hands, some 60 men and boys, a few elderly females, and about 80 girls. These latter resemble much the factory girls at home; the same merry countenances and laughing twinkling eyes, unabashed, but perfectly orderly, though perhaps a little negligent upon the appearance of visitors. . . . . We were highly gratified with our visit, showing as it did that there is a wide and very hopeful field for the development of industries in Japan."

WE have on our table the following books :—"Mathematical Drawing Instruments," by W. Ford Stanley, E. and F. N. Spon; "Crystallography," Henry Palin Gurney, S.P.C.K.; "Outlines of the Geology of Northumberland," G. A. Lebour, H. Sotheran and Co.; "Coal and Iron in all Countries of the World," John Pechar, Simpkin and Co.; "Abriss der praktischen Astronomie," Dr. A. Sawitsch, Wilhelm Manke; "A First Catechism of Botany," John Gibbs, Durrant; "The Present State of Electric Lighting," J. N. Schoolbred, Hardwick and Bogue; "The House-Surgeon," Alf. Smee, F.R.S., Accident Insurance Company; "The Geological Record for 1876," edited by William Whitaker, Taylor and Francis; "Etna," G. F. Rodwell, Kegan Paul and Co.; "Spiritual Science," Kuklos, John Harris; "Instructions for Testing Telegraph Lines," Vol. I., Louis Schwendler, Trübner; Health Primers—"Premature Death —Alcohol," "Exercise and Training," "The House," Hardwick and Bogue; "Gegenbaur's Elements of Comparative Anatomy," translated by F. Jeffrey Bell and E. Ray Lankester, Macmillan and Co.

MR. E. P. RAMSAY, Curator to the Australian Museum, Sydney, has prepared and issued "Hints for the Preservation of Specimens of Natural History for Museum Purposes." This short pamphlet contains useful directions for unskilled taxidermists, and notes on the preservation of entire animals of small size. It contains occasional remarks on Australian animals, and suggestions specially appropriate to the wants of naturalists in the bush; these are the only novelties. It will be seen that the title is rather too comprehensive for the contents of the paper; and now that we are beginning to look a little beyond the mere collection of dried skins, it is disappointing to find the internal organs of animals treated as so much matter to be got rid of.

THE last volume of *Medical Reports*, issued by order of the Inspector-General of Customs in China, contains a contribution of considerable interest to our knowledge of the geographical distribution of disease. The notes we refer to, which are by Mr. E. Rocher, of the Customs' Service, prove that the plague exists in China, and that it has in late years spread over a larger area than is generally known. They also show that the disease did not, as some believe, entirely disappear between 1844 and 1873, and it is thought by no means improbable that it may have passed from Yünnan to Mesopotamia or Persia. In Yünnan the disease is known as *Yang-toze*, and is believed to have been originally imported from Burmah. When that was it is impossible to determine, but since the commencement of the civil war it has spread over the whole province, decimating the population. There is one fact which inclines Mr. Rocher to think that the epidemic is owing to exhalations from the soil, viz., that those animals which live in the ground, in drains, or in holes, are the first to be attacked, and this is particularly noticeable with rats. As soon as these animals are ill they leave their holes in troops, and, after staggering about and falling over each other, drop down dead. The same phenomenon occurs in the case of other animals, such as buffaloes, oxen, sheep, deer, pigs, and dogs; all are attacked, but the dog less severely than the others. When these phenomena appear it is not long before the disease spreads to man, and, knowing this, the people do

what they can to guard themselves against it. They begin to purify their houses by lighting fires in every room, and in certain towns they abstain from pork. Mr. Rocher gives details as to the symptoms and course of the disease. With regard to the track of the epidemic Mr. Rocher observed a peculiar fact both in the north and south of the province. Instead of visiting every village in its direct line of progress it would pass some completely by, visiting places near them and on both sides, to return to those forgotten spots several months afterwards, when the epidemic would appear to have passed far away. Another fact not less curious is that after having appeared in almost every one of the villages scattered about the plains, it frequently ascends the mountains, where, among the aborigines who inhabit the high lands, it claims many victims. We may add that Mr. Rocher's notes are accompanied by a map, compiled from private and official memoranda, which shows the course followed by the plague in 1871, 72, and 73; it was not possible, however, to include in it the towns in the west of the province, which was at that time the theatre of the war between the Imperialists and the Mahometan rebels, as the information obtainable was quite untrustworthy, but it is certain that the epidemic was constantly present among the Imperialist troops.

THE additions to the Zoological Society's Gardens during the past week include a Green Monkey (*Cercopithecus callitrichus*) from West Africa, presented by Miss G. E. Marryat; a Bonnet Monkey (*Macacus radiatus*) from India, presented by Mr. F. Hinde; two Horsfield's Tortoises (*Testudo horsfieldi*) from Turkestan, presented by Dr. Alex. Strauch, C.M.Z.S.; a Wanderoo Monkey (*Macacus silenus*) from Malabar, two Egyptian Jerboas (*Dipus ægyptius*) from Egypt, a Sun Bittern (*Eurypyga helias*) from South America, deposited; a Woodcock (*Scolopax rusticola*), European, purchased.

CHARLES ADOLPHE WURTZ

IN connection with the Faraday Lecture which follows, it may interest our readers to have a few particulars as to the life and work of the lecturer, Prof. Wurtz.

Charles Adolphe Wurtz was born at Strassburg on November 16, 1817. He commenced his chemical career as assistant to Dumas, and first acquired an independent position as professor at the Agricultural Institute at Versailles. For the last thirty years he has been Professor of Chemistry at the École de Médecine, Paris; in addition to which he now holds the post of Professor of Chemistry at the Sorbonne.

Prof. Wurtz is a member of the Institute (Académie des Sciences), and a foreign Fellow of the Royal Society.

Some idea of the energy which he has displayed as an investigator is conveyed by the fact that a list of no less than seventy-three titles of papers is appended to his name in the Royal Society Catalogue, which only includes papers published previous to 1864. Much of his work is of the first importance in connection with chemical theory, and he undoubtedly takes rank as one of the chief pioneers of modern organic chemistry.

His first investigation, published in 1842, was on the constitution of the hypophosphites; this was followed by researches on phosphorous acid, sulpho-phosphoric acid, &c., which greatly added to our knowledge of the phosphorus compounds. It was in the course of his experiments on the hypophosphites that Wurtz discovered hydride of copper, Cu_2H_2, one of the most remarkable hydrides with which we are acquainted, and especially interesting as, with the exception of potassium, sodium, and perhaps palladium, none of the metals appear to be capable of combining with hydrogen. Hydride of copper is formed as a yellowish precipitate on adding a concentrated solution of copper sulphate to a solution of hypophosphorous acid, and warming the mixture to about 70° C.; in the dry state it slowly decomposes into its constituents at about 55° C.; concentrated hydrochloric acid at once dissolves it with evolution of hydrogen, although copper is not in the least affected by this acid, and what is most remarkable, both the hydrogen of the acid and of the hydride of copper are given off as shown by the equation—

$$Cu_2H_2 + 2HCl = Cu_2Cl_2 + 2H_2.$$

The study of certain cyanogen compounds—the cyanic and cyanuric ethers—next engaged his attention, and his researches on these bodies culminated in the remarkable discovery, in 1849, of the so-called compound ammonias formed by the displacement of one of the atoms of hydrogen in ammonia, NH_3, by organic radicles, such as methyl, CH_3, ethyl, C_2H_5, &c.

A third investigation to which we may here refer is that on the alcohol radicles published in 1855. Frankland had shown that the hydrocarbon radicles which it was assumed were contained in the alcohols could actually be isolated; that, from ordinary or ethyl acohol, for example, which may be regarded as a compound of the radicle ethyl, C_2H_5, with the radicle OH, we may obtain ethyl by acting with zinc on the iodide which it yields on treatment with hydriodic acid, thus withdrawing the iodine from it, just as the iodine is withdrawn from the hydrogen in hydriodic acid by the action of metals; and Kolbe had obtained similar results with acids, such as acetic acid, by submitting solutions of their salts to the action of a powerful electric current. These chemists, however, supposed that the radicles thus withdrawn from combination with other radicles remained in the free state, but Laurent and Gerhardt, and Hofmann argued on theoretical grounds that the bodies thus produced were not the radicles themselves but compounds of the radicles with themselves—that ethyl, for example, was not C_2H_5, but C_4H_{10} or $C_2H_5 + C_2H_5$. Conclusive evidence of the correctness of this latter view was afforded by Wurtz's discovery that if a mixture of the iodides of two different radicles were treated with metallic sodium, a hydrocarbon formed by the union of the two different radicles was obtained. This discovery has afforded one of the chief arguments in favour of the view now almost universally entertained by chemists, that free hydrogen is a compound of hydrogen with hydrogen.

The mere recapitulation of the titles of his remaining investigations would alone occupy a large amount of space. We can only refer to those on the glycols and on ethylene oxide; on the action of nascent hydrogen on aldehyde; on the action of chlorine on aldehyde, both in the anhydrous state and in presence of water; on the action of hydrochloric acid on aldehyde; on the synthesis of neurine; and on abnormal vapour densities, as being, among others, of especial interest.

ON THE CONSTITUTION OF MATTER IN THE GASEOUS STATE[1]

LADIES AND GENTLEMEN,—

I ESTEEM it a great honour to address you within these walls, about which there still hovers the ever fresh memory of him whose name we celebrate to-day, while we deplore his loss. I am fully sensible both of the great value of this honour and of the danger that attends it, and I have need to shelter myself under the authority of the great name of FARADAY. I have, therefore, chosen a subject connected with his earliest discoveries. The constitution of matter is a question of the highest importance with regard both to physics and to chemistry.

The word "gas" was introduced into science by Van Helmont, who, at the beginning of the seventeenth century, first pointed out, with some degree of precision, the differences existing be-

[1] The Faraday lecture, delivered before the Fellows of the Chemical Society, in the Theatre of the Royal Institution, on Tuesday, November 12, 1878, by Ad. Wurtz, Membre de l'Institut; Doyen Honoraire de la Faculté de Médecine de Paris.